

Claims

1. A mould set for use in a method of moulding plastics articles wherein a preform is injection-moulded in an injection moulding cavity and the
5 injection-moulded preform is blow-moulded in a blow-moulding cavity, said mould set comprising an array of injection-moulding cavities and an array of blow-moulding cavities, each of the cavities in each of the arrays being defined by at least two mould parts separable in a respective mould separation direction, wherein the mould separation directions of said injection-moulding cavities and
10 of said blow-moulding cavities each define a common mould separation direction whereby, in use, the mould set may be opened in the common mould separation direction to release the injection-moulded preforms and the blow-moulded products.

2. A mould set as claimed in Claim 1, wherein the blow-moulding
15 cavities are generally elongate, with the longitudinal axes of the blow-moulding cavities extending generally perpendicularly to the common mould separation direction.

3. A mould set as claimed in Claim 1 or Claim 2, wherein the blow-moulding cavities are disposed in an array to one or both sides or towards the
20 top and/or bottom of the mould set, with the necks of the blow-moulding cavities arranged adjacent the periphery of the mould set.

4. A mould set as claimed in any of the preceding Claims, wherein the injection-moulding cavities are disposed in a generally central array in the mould set.

5. A mould set as claimed in any of the preceding Claims wherein each injection-moulding cavity is aligned with a respective blow-moulding cavity.

6. A mould set as claimed in Claim 5, wherein the blow-moulding cavities are arranged as a group of a preset number (n) of rows (or columns) of a preset number (m) of cavities on one side of the mould set and a generally symmetric group of said preset number (n) of rows (or columns) of (m) cavities on an opposite side of the mould set, with the necks of the blow-moulding cavities facing outwardly on the edges of the mould sets, and the injection-mould cavities are disposed between the two groups of blow-moulding cavities, and arranged in a rectangular array of $(2n \times m)$ cavities.

7. A mould set as claimed in Claim 6, comprising at least two rows (or columns) of blow-moulding cavities on each side of said moulding set, the rows (or columns) being stacked in the direction of the common mould-separation direction.

8. A mould set as claimed in Claim 5, wherein the blow-moulding cavities are disposed in two rows (or columns) of cavities at equal spacing, one to either side of the mould set, with the rows or columns being offset with respect to each other by one half the cavity spacing, and the injection-moulding cavities are disposed in a single column or row disposed generally centrally between the moulding cavities and each being aligned with a respective blow-moulding cavity.

9. A mould set according to any of the preceding Claims, comprising two main body portions, and a plurality of modular, removable or replaceable mould set components.

10. A mould set according to Claim 9, wherein said modular mould set components include one or more of the following:

injection cores

injection neck formers

5 injection cavity plates (housings)

injection cavities, and

blow cavities.

11. An injection moulding apparatus for injection (stretch) blow-moulding of plastics articles, said apparatus comprising:

10 a mould set comprising an array of injection-moulding cavities and an array of blow-moulding cavities, each of the cavities in each of the arrays being defined by at least two mould parts separable in a respective mould separation direction, wherein the mould separation directions of said injection-moulding cavities and of said blow-moulding cavities define a common mould separation
15 direction whereby, in use, the mould may be opened in the common mould separation direction to release the injection-moulded preforms and the blow moulded products;

injection means for injecting plastics material into said injection-moulding cavities to produce said injection-moulded preforms;

20 mould opening means for opening and closing said mould set in use to allow release of injection-moulded preforms and blow-moulded products;

preform transfer means for transferring injection-moulded preforms from the injection-moulding cavities to the blow-moulding cavities;

blow-moulding means associated with said blow-moulding cavities and

operable for blow-moulding injection-moulded preforms thereinto.

12. An injection moulding apparatus according to Claim 11, including two facing platen means mounted on a base structure, wherein a first part, or array of parts, of said mould set is secured to one of said platen means and a second part, or array of parts, of said mould set is secured to the other of said platen means, the apparatus further including platen drive means for effecting relative linear movement of said mould parts between a closed position and an open position, to serve as said mould opening means.

13. An injection-moulding apparatus according to Claim 11 or Claim 12, wherein the blow-moulding cavities include neck regions disposed adjacent the edge of the mould set and externally accessible transversely relative to the axis of said opening and closing movement.

14. An injection-moulding apparatus according to Claim 13, wherein said blow-moulding means are disposed generally transversely of said mould set and are operable to apply blow-moulding pressure via said neck region.

15. An injection moulding apparatus according to Claim 14, including an elongate stretch means operable to be introduced in use transversely into the cavity within a preform held in a blow-moulding cavity, thereby to apply a stretching force before or during the blow-moulding.

16. An injection-moulding apparatus according to any of Claims 11 to 15, including an array of injection core means and an array of injection neck forming means, for co-operating with said array of injection-moulding cavities.

17. An injection-moulding apparatus according to Claim 16, wherein the number of injection-mould core means is equal to the number of injection-

moulding cavities.

18. An injection-moulding apparatus according to Claim 16, wherein the number of injection-mould core means is an integral multiple of the number of injection-moulding cavities.

5 19. An injection-moulding apparatus according to Claim 16, wherein the number of injection neck forming means is equal to the number of injection-moulding cavities.

20. An injection-moulding apparatus according to Claim 16, wherein the number of injection-neck forming means is an integral multiple of the number
10 of injection-moulding cavities.

21. An injection-moulding apparatus according to Claim 19, wherein the array of neck-forming means is operable in use to transfer the injection-moulded preforms from the array of injection-moulding cavities along at least part of the way to the array of blow-moulding cavities.

15 22. An injection-moulding apparatus according to any of the Claims 19 to 21, including perform transfer means for transferring in use injection-moulded preforms to the blow-moulding cavities from at least part of the way along the path from the injection-moulding cavities.

20 23. An injection-moulding apparatus according to Claim 22, wherein said preform transfer means comprises an array of neck gripping means for engaging in use the neck of a preform.

24. An injection moulding apparatus according to Claim 15 or any Claim dependent thereon, which comprises actuation means for introducing and withdrawing said elongate stretch means to and from the blow-moulding cavities,

said actuation means being further operable to apply movement to move said preforms from said injection-moulding cavities to said blow-moulding cavities and/or to transfer said blow-moulded products from said blow-moulding cavities.

25. An injection moulding apparatus according to Claim 11 or any claim dependent thereon, further including thermal conditioning means for exposing said injection moulded preforms to a thermal conditioning step following injection moulding thereof and prior to said blow moulding.

26. A method of blow-moulding plastics articles, which comprises the steps of:-

10 providing a mould set comprising an array of injection-moulding cavities and an array of blow-moulding cavities, each of the cavities in each of the arrays being defined by at least two mould parts separable in a respective mould separation direction, wherein the mould separation directions of said injection-moulding cavities and of said blow-moulding cavities define a common mould separation direction whereby, in use, the mould may be opened in the common
15 mould separation direction to release the injection-moulded preforms and the blow moulded products;

locating a plurality of previously injection-moulded preforms in said blow-moulding cavities;

20 closing said mould set;

forming injection-moulded preforms using said injection-moulding cavities;

stretching and/or blow-moulding said previously injection-moulded preforms into said blow-moulding cavities;

opening said mould set to release said injection-moulded preforms and

said blow-moulded products, and

transferring said injection-moulded preforms to said blow-moulding cavities.

27. A method according to Claim 26, operated cyclically, wherein in
5 each period between the mould closing and the mould opening, a plurality of injection-mould preforms are formed in the injection-moulding cavities and a plurality of previously formed injection moulded performs are blow-moulded in said blow-moulding cavities.

28. A method according to Claim 25 or Claim 26, wherein said
10 injection moulded preforms are exposed to a thermal conditioning step release from following injection-moulding thereof and prior to said blow-moulding.